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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/611,955	07/06/2000	Cyprian Emeka Uzoh	FI9-97-205B	6678

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INTERNATIONAL BUSINESS MACHINES CORPORATION
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EXAMINER

VU, HUNG K

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 05/16/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/611,955

Applicant(s)

UZOH ET AL.

Examiner

Hung Vu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 February 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 25-32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 25-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 25-32 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The limitations (“a conductive barrier located over said insulating layer in said recess and over said at least one major surface” and “a conductive metal in said recess only”), as recited in claim 25, are not supported by the specification and/or drawings. Note that Figure 3 shows the conductive barrier (4) located over the insulating layer (3) in recess and over at least one major surface, but does not show the conductive metal (8) is in recess only. Figure 4, on the other hand, shows the conductive metal (8) in recess only and the conductive barrier (4) located over the insulating layer (3) in recess, but does not show the conductive barrier (4) located over at least one major surface. Also note that Figure 3 is an intermediate structure, while Figure 4 is a final structure. Therefore, none of the claims read on a single disclosed embodiment.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are

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such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 25 and 28 – 32, insofar as in compliance with 35 USC 112, are rejected under 35 U.S.C. 103(a) as being unpatentable over Jain (PN 5,821,168, of record) in view of Shibata (PN 4,577,395, of record).

Jain discloses, as shown in Figure 10, a semiconductor structure comprising:

- a substrate (26,54);
- recess (72) located in at least one major surface of the substrate;
- electrical insulating layer (56) located over the at least one major surface and in the recesses;
- a conductive barrier (TiN disclosed in Col. 5, lines 38-43) located over the insulating layer in the recess;
- a seed layer (60) located over the conductive barrier within the recess only;
- a conductive metal (62) in the recess only (see Figure 9). Note that at the final structure, the seed layer and the conductive metal layer (74) is in recess only.

Jain does not disclose the structure is formed in a semiconductor substrate. However, Shibata discloses a formation of a structure in a semiconductor substrate (10). Note Figures 1G, 3G, 5G, 6G and 7G of Shibata. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the structure of Jain in the semiconductor substrate, such as taught by Shibata in order to increase the packing density with the formation of a plurality of structures.

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Note that the term “plating” is method recitation in a device claimed. “[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.” *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Regarding claim 28, Jain and Shibata disclose the seed layer is copper (Col. 4, line 14).

Regarding claim 29, the term “sputtered” is method recitation in a device claimed. “[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.” *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Regarding claim 30, Jain and Shibata disclose the copper is approximately 50 – 150 Å thick (within the range of about 100 to about 2000 Å) (Col. 4, lines 14-20).

Regarding claim 31, Jain and Shibata disclose the conductive metal is copper (Col. 4, lines 28-29).

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Regarding claim 32, Jain and Shibata disclose the conductive metal is about 6000 Å to 15,000 Å thick (within the range of 4000 Å to 30,000 Å) (Col. 4, lines 28-29).

3. Claims 26 and 27, insofar as in compliance with 35 USC 112, are rejected under 35 U.S.C. 103(a) as being unpatentable over Jain (PN 5,821,168, of record) in view of Shibata (PN 4,577,395, of record) and further in view of Maekawa (PN 6,329,284, of record).

Regarding claim 26, Jain and Shibata disclose the claimed invention including the semiconductor structure as explained in the rejection above. Jain and Shibata further disclose the formation of the barrier layer. Jain and Shibata do not disclose the barrier layer comprises a layer of tantalum nitride adjacent the insulating layer and a layer of tantalum above the tantalum nitride layer.

However, Maekawa discloses a semiconductor structure having a barrier layer (5) comprises a layer of tantalum nitride adjacent an insulating layer (3) and a layer of tantalum above the tantalum nitride layer. Note Figures 7-10 and Col. 5, lines 44-58 of Maekawa. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the barrier of Jain and Shibata comprising a tantalum nitride layer and a tantalum layer above the tantalum nitride layer, such as taught by Maekawa in order to provide a better adhesion between the conductive metal and the insulation layer.

Regarding claim 27, Jain, Shibata and Maekawa disclose the tantalum nitride layer is about 15 to about 500 Å thick and the tantalum layer is about 500 to about 5000 Å thick (Col. 5, lines 44-58).

Response to Arguments

4. Applicant's arguments filed 02/28/06 have been fully considered but they are not persuasive.

It is argued, at pages 2-3 of the Remarks, that the specification expressly discloses, at page 8, lines 1-2, "a conductive barrier located over the insulation layer" and, at page 6, lines 19-22, "a conductive metal in said recesses only". This argument is not convincing because the description at page 8, lines 1-2, referred to the embodiment in which the electrical insulation layer formed over the major surface of the semiconductor substrate and in the recesses. On the other hand, the description at page 6, lines 19-22, referred to embodiments in which the insulation layer having recesses formed over the major surface of the semiconductor substrate. Appellant combines different features of different embodiments to come up with the subject matter of claim 25, and fails to provide the description in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the

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teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Jain does not disclose the structure is formed in a semiconductor substrate, and Shibata discloses a formation of a structure in a semiconductor substrate. Therefore, one of skill in the art would be motivated to form the structure of Jain in the semiconductor substrate, such as taught by Shibata in order to increase the packing density with the formation of a plurality of structures.

It is argued, at page 3 of the Remarks, that to include layers of tantalum nitride and a layer of tantalum as mentioned by Maekawa would be contrary to the stated objections of Jain and therefore not an obvious modification. This argument is not convincing because Jain discloses, as shown in Col. 5, lines 38-43, a barrier (TiN), but does not disclose a barrier is a combination of TaN and Ta. Maekawa discloses a barrier layer is a combination of TaN and Ta. Therefore, one of skill in the art would be motivated to form the barrier of Jain comprising TaN and Ta in order to provide better adhesion between the conductive metal and the insulation layer.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed

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invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hung Vu whose telephone number is (571) 272-1666. The examiner can normally be reached on Tuesday to Friday 6:00-4:30.

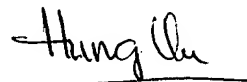
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on (571) 272 - 1732. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Vu

May 9, 2006

A handwritten signature in black ink, appearing to read "Hung Vu", written over a horizontal line.

Hung Vu

Primary Examiner